Applicants' : Bruce J. Barrett et al.
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In the Claims:

Please cancel claims 9, 25 and 41 and amend claims 1-5, 7, 10-11, 17-24, 26-31, 33, 35, 40, 42, 44, 48-54 and 56-62 to read as follows:

1. (Twice Amended) A method for comparative spectrophotometric in vivo monitoring and display of selected blood metabolites present in a plurality of different internal regions of the same test subject on a continuing and substantially concurrent basis, comprising the steps of:

applying separate spectrophotometric sensors to a test subject at each of a plurality of separate testing sites and coupling each of said sensors to a control and processing station;

operating a selected number of said sensors on a substantially concurrent basis to spectrophotometrically irradiate at least two separate internal regions of the test subject during a common time interval, each of said regions being associated with a different of said testing sites;

separately detecting and receiving light energy resulting from said spectrophotometric irradiation for each of said at least two separate internal regions, and conveying separate sets of signals to said control and processing station which correspond to the separately detected light energy from said at least two separate internal regions;

separately and concurrently analyzing said conveyed separate sets of signals to separately determine quantified data representative of a blood metabolite in each of said at least two separate internal regions; and

concurrently visually displaying said separately determined quantified data for each of said at least two separate internal regions for direct concurrent mutual comparison, wherein said sensors are applied to a head of the test subject and are used to monitor two mutually separate regions within a brain of the test subject.

2. (Twice Amended) The method of claim 1, wherein said step of analyzing comprises quantitative determination of blood oxygenation levels within each of said at least two separate internal regions.

3. (Amended) The method of claim 2, wherein said analyzing step includes producing separate quantitative value determinations for hemoglobin oxygen saturation for each of said at least two separate internal regions.

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4. (Amended) The method of claim 3, wherein said analyzing step includes production of ongoing graphical traces representing a plurality of said quantitative value determinations made at successive points in time.

7 ~~5.~~ (Amended) The method of claim 3, including the step of visually displaying a plurality of said quantitative value determinations at substantially the same time and in predetermined relationship to one another to facilitate rapid and accurate visual comparison.

B3 6 ~~7.~~ (Amended) The method of claim 5 ~~6~~, including the step of visually displaying a plurality of said quantitative value determinations at substantially the same time and in predetermined relationship to one another to facilitate rapid and accurate visual comparison.

9. (Canceled)

8 ~~10.~~ (Amended) The method of claim 1, wherein said metabolite comprises hemoglobin oxygen.

B4 9 ~~11.~~ (Twice Amended) The method of claim 1, wherein said sensors are positioned in locations proximate to different brain hemispheres and said two mutually separate regions are located in a different brain hemisphere.

B5 11 ~~12.~~ (Twice Amended) An apparatus for concurrent comparative spectrophotometric in vivo monitoring of selected blood metabolites present in each of a plurality of different internal regions on a continuing basis, comprising:

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a plurality of spectrophotometric sensors, each attachable to a test subject at different test locations and adapted to separately but concurrently spectrophotometrically irradiate at least two different internal regions within the test subject associated with each of said test locations;

a controller and circuitry coupling each of said sensors to said controller for separately and individually but concurrently operating certain of said sensors to spectrophotometrically irradiate each of said different internal regions within the test subject associated with each of said test locations;

said sensors each further adapted to receive light energy resulting from the separate spectrophotometric irradiation of said sensors associated one of said at least two different internal regions on a substantially concurrent basis with other said sensors, and to produce separate signals corresponding to the light energy received, said circuitry acting to convey said separate signals to said controller for separate analytic processing;

said controller adapted to analytically process said conveyed signals separately and thereby determine separate quantified blood metabolite data therefrom for each of said sensors and said sensors associated one of said at least two different internal regions; and

a visual display coupled to said controller and adapted to separately but concurrently display the quantified blood metabolite data determined for each of said sensors in a mutually-comparative manner, wherein said sensors are adapted to be applied to a head of the test subject and to monitor a brain of the test subject.

18. (Twice Amended) The apparatus of claim 11, wherein said controller is adapted to analyze said data to quantitatively determine blood oxygenation within said at least two different internal regions.

19. (Twice Amended) The apparatus of claim 12, wherein said controller is adapted to produce separate numeric value designations for hemoglobin oxygen saturation for said at least two different internal regions.

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14 20. (Amended) The apparatus of claim ~~19~~ 13, wherein said controller and said display are adapted to produce ongoing graphical traces representing a plurality of said numeric value designations for the same region taken over a period of time.

17 21. (Amended) The apparatus of claim ~~19~~ 13, wherein said controller and said display are adapted to visually display at least two of said numeric value designations on a substantially concurrent basis and in predetermined relationship to one another to facilitate rapid and accurate visual comparison.

B515 22. (Amended) The apparatus of claim ~~20~~ 14, wherein said controller and said display are adapted to visually display at least two of said graphical traces on a substantially concurrent basis and in predetermined relationship to one another to facilitate rapid and accurate visual comparison.

16 23. (Amended) The apparatus of claim ~~22~~ 15, wherein said controller and said display are adapted to visually display at least two of said numeric value designations as well as at least two of said graphical traces on a substantially concurrent basis and in proximity to one another to facilitate rapid and accurate visual comparison.

18 24. (Amended) The apparatus of claim ~~17~~ 11, wherein said sensors are adapted to provide signals to said controller which comprise at least two separate data sets that cooperatively define at least portions of a particular area within a given one of said at least two different internal regions.

25. (Canceled)

B6 26. (Amended) The apparatus of claim ~~17~~ 11, wherein said controller is adapted to determine blood oxygenation saturation in said brain.

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22 ~~27~~. (Twice Amended) The apparatus of claim ~~17~~ 11, wherein at least two of said sensors are adapted to be positioned in locations associated with mutually different hemispheres of the brain and each of said sensors is operable to separately monitor at least portions of each of said different hemispheres.

23 ~~28~~. (Twice Amended) The apparatus of claim ~~27~~ 22, wherein said controller is adapted to determine cerebral blood oxygenation saturation within each of said different hemispheres.

B6 C2d ~~29~~. (Twice Amended) The apparatus of claim ~~27~~ 22, wherein said sensors are adapted to provide signals to said controller which comprise at least two data sets that cooperatively define at least portions of a particular area within the same hemisphere of said brain.

19 ~~30~~. (Twice Amended) The apparatus of claim ~~24~~ 18, wherein said data sets provided by said sensors include a first set characterizing a first part of said particular area and a second set characterizing a second part of said particular area.

20 ~~31~~. (Twice Amended) The apparatus of claim ~~30~~ 19, wherein said second part of said particular area characterized by said second set includes at least part of said first part of said area.

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26 ~~33~~. (Twice Amended) A method for concurrent comparative in vivo monitoring of blood metabolites in each of a plurality of different internal regions in a selected test subject, comprising the steps of:

B7 spectrophotometrically irradiating each of a plurality of different testing sites on said test subject;

detecting light energy resulting from said spectrophotometric irradiation of said testing sites, and providing separate sets of signals to a control and processing station which are representative of the light energy received by each of said testing sites and which cooperatively define blood metabolite data for an individual one of at least two different internal regions;

analyzing said separate signals to determine quantified blood metabolite data representative of at least one defined region within said at least one test subject associated with each of at least two different of said testing sites, each said defined region being different from the other; and

concurrently displaying data sets for each of said at least two different internal regions at substantially the same time for direct mutual comparison, wherein said at least two different internal regions are located within different brain hemispheres of said test subject.

27 26
~~35.~~ (Twice Amended) The method of claim ~~33~~, wherein said data sets include a first set which characterizes a first zone within one of said at least two different internal regions and a second set which characterizes a second zone that is at least partially within the same one of said at least two different internal regions.

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~~40.~~ (Twice Amended) The method of claim ~~33~~, wherein said spectrophotometric irradiation comprises application of at least two different wavelengths applied in an alternating sequence of timed pulses, and wherein detection of light energy corresponding to each of said at least two different wavelengths is done on a timed periodic basis using detection periods whose occurrence generally corresponds to that of said applied spectrophotometric irradiation.

41. (Canceled)

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~~42.~~ (Twice Amended) The method of claim ~~40~~, wherein the duration of each of said detection periods is limited to a length which is less than that of each pulse of applied spectrophotometric irradiation.

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~~44.~~ (Amended) The method of claim ~~43~~, wherein a plurality of said detection periods are used during pulses of said applied spectrophotometric irradiation, and a corresponding energy detection occurs during each of a plurality of said detection periods.

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35 48. (Twice Amended) Apparatus for spectrophotometric in vivo monitoring of a selected metabolic condition in each of a plurality of different test subject regions on a substantially concurrent basis, comprising:

a plurality of spectrophotometric emitters, each adapted to separately spectrophotometrically irradiate a designated region within a test subject from a test location on said test subject;

B 12 a controller and circuitry coupling each of said emitters to said controller for individually operating selected ones of said emitters to spectrophotometrically irradiate at least two particular regions within the test subject;

a plurality of detectors, each adapted to separately receive light energy resulting from the spectrophotometric irradiation of said at least two particular regions, and to produce at least one separate set of signals for each one of said at least two particular regions; and circuitry acting to convey said at least one separate set of signals to said controller for analytic processing;

said controller adapted to analytically process said at least one separate set of signals to determine separate sets of quantified data representative of a metabolic condition in said at least two particular regions; and

a visual display coupled to said controller and adapted to display separate representations of said separate sets of quantified data for each of said at least two particular regions in a mutually-comparative manner and on a substantially concurrent basis, wherein at least two of said at least two particular regions are located in mutually separate regions of a brain of said test subject.

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36 49. (Twice Amended) The apparatus of claim 48, wherein said controller includes a computer programmed to analyze said signals to separately determine a blood oxygenation state within each of said at least two particular regions.

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37 50. (Amended) The apparatus of claim 49, wherein said computer comprises a processor, data buffers, and a timing signal generator, said data buffers adapted to store data

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representative of said blood oxygenation state and said timing signal generator adapted to control actuation of said emitters and detectors.

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58/51. (Amended) The apparatus of claim ~~49~~, wherein said controller comprises a unitary device which includes said computer and said display.

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B12 79/~~52~~. (Amended) The apparatus of claim ~~51~~, wherein said unitary device further includes a keyboard interface to said computer.

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40/~~53~~. (Amended) The apparatus of claim ~~51~~, wherein said unitary device further includes a data output interface.

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41/~~54~~. (Amended) The apparatus of claim ~~53~~, wherein said unitary device further includes an integral keyboard interface to said computer.

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43/~~56~~. (Amended) The apparatus of claim ~~55~~, wherein said unitary device further includes an integral keyboard interface to said computer.

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44 ~~57~~. (Amended) The apparatus of claim ~~48~~, wherein at least certain of said detectors and certain of said emitters comprise operational pairs, and said controller is arranged to operate B13 the emitters and detectors of at least certain of said operational pairs in predetermined timed relationship while maintaining the emitters and detectors of other of said operational pairs in a non-operating condition.

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45/~~58~~. (Amended) The apparatus of claim ~~57~~, wherein said controller is adapted to sequence the operation of said at least certain of said operational pairs.

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48/~~59~~. (Twice Amended) The apparatus of claim ~~57~~, wherein at least one of said operational pairs includes a first detector and a second detector, and wherein the first detector is located

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nearer the emitter than the second detector to thereby provide near and far detector groupings for said at least one of said operational pairs.

46 ~~60.~~ (Amended) The apparatus of claim 45 ~~58~~, wherein at least one of said operational pairs include a plurality of said detectors arranged at mutually spaced locations which are spaced at differing distances from the emitter of said at least one of said operational pairs.

B/3 49 ~~61.~~ (Amended) The apparatus of claim 48 ~~59~~, wherein said controller is adapted to sequence the operation of said at least one of said operational pairs.

47 ~~62.~~ (Amended) The apparatus of claim 46 ~~60~~, wherein said controller is adapted to operate the emitter and a selected number less than all of the detectors of at least one of said operational pairs substantially in unison while holding the other detectors of said at least one of said operational pairs in a non-operating condition, and said controller is further arranged to operate said other detectors substantially in unison with said emitter at another time during which said selected number of said detectors are maintained in a non-operating condition.